



Building Educator Capacity

In K-12 Teaching and Learning to Broaden
Participation in Computer Science Education

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Objective

This brief provides a foundational overview of Computer Science (CS) education in North Carolina so that we may better address the geographical and professional areas of needs of schools. This analysis supports district-level planning for CS education in North Carolina, emphasizing equitable access and teacher preparedness to meet the CS graduation requirement. This information will allow a better understanding of where discrepancies lie in North Carolina CS education and aid in developing a plan of action to create a more inclusive environment for all students.

Executive Summary

This brief provides a data-informed overview of K–12 Computer Science (CS) education in North Carolina to support strategic district-level planning. It highlights access gaps, participation disparities and a shortage of prepared educators, particularly in rural and under-resourced areas. Despite strong infrastructure in course offerings, student engagement and teacher preparation remain critical challenges. With the state’s new CS graduation requirement taking effect, this brief provides recommendations to ensure equitable, high-quality CS opportunities for all students.

Education Program Analysis of North Carolina: CS Education Programs

Programs	Grade Level	Approach	Organization
Code.org CS Discoveries and Principles	6-12	Standalone	The Friday Institute
Beauty and Joy of Computing (BJC)	9-12	Standalone	NC State
Minecraft Education	6-12	Standalone	Microsoft/Prodigy Learning
District Implementation Program	K-12	SCRIPT	The Friday Institute
Adobe Certification	9-12	Certification	Adobe
Girls who Code	3-12	After School	Local Schools
Python Programming	9-12	Standalone	NC DPI
Project Lead the Way	6-12	Standalone	PLTW
CS30 - Introduction to Data Science	6-12	Standalone	The Science House at NC State and NC Department of Education
Elementary Cybersecurity	K-5	Standalone	NC DPI and The Friday Institute

Identifying Access and Participation Gaps

Based on data collected for the Common Metrics Program, 577 out of 604 high schools in North Carolina offer access to at least one computer science course (ECEP Alliance, 2023). There are three categories of Computer Science Courses:

- ➔ Core CS Courses: These courses explicitly cover computer science skills. Examples include Computer Science Principles, AP Computer Science A and Python Coding
- ➔ CS Courses: These CS courses are more specialized in various areas of computer science. Examples include SAS Base Programming, CompTIA IT Fundamentals and Introduction to Data Science
- ➔ CS Related Courses: These courses include elements of computer science. Examples include Game Art and Design and Technology Engineering and Design

All CS and CS Related courses will allow students to meet the North Carolina High School Computer Science Requirement (SL 2023-132).

Partial List of NC Computer Science Courses	Partial List of NC Computer Science Related Courses
➔ AP Computer Science Principles ➔ AP Computer Science A ➔ CIS110 Introduction to Computers ➔ CompTIA IT Fundamentals ➔ IB Computer Science SL ➔ Python Programming I ➔ SAS Base Programming	➔ 3D Modeling and Animation I ➔ Adobe Visual Design I ➔ Adobe Digital Design I ➔ Game Art and Design ➔ Microsoft Excel ➔ PLTW Principles of Engineering ➔ Technology Engineering and Design

Despite more than 95% of high schools offering CS courses, only 7% of students elected to take a CS course during the 2022-23 school year. 9% of males took a CS course, nearly double the rate of females at 5% (ECEP Alliance, 2023).

- 9108 (26%) students who identify as female
- 4036 (18%) Black/African American
- 7466 (34%) economically disadvantaged students

Out of 603 high schools, 439 offered introductory Core CS courses, but only 327 schools had students enrolled in Core CS courses (ECEP Alliance, 2023). Charter schools also suffer from a lack of computer science courses. In 2023, 40 out of 104 charter high schools in the state have no CS or CS related course offerings.

During the 2022-2023 school year, all but three school districts (Jones County Schools, Montgomery County Schools and Perquimans County Schools) offered some form of CS or CS-related course at the high school level. However, if CS-related courses are removed, the number goes up to 23 counties (ECEP Alliance, 2023).

District and School Computer Science Education Barriers

Several districts have made a conscious effort to bring comprehensive computer science access to their students. Counties such as Robeson and Guilford County schools have ensured that every middle and high school offer a core computer science course, while Pitt, Watauga and Charlotte Mecklenburg schools have held district workshops to train teachers from their high schools.

The Friday Institute, with the support of Code.org and the NC Department of Public Instruction, have also begun an initiative to prepare districts for comprehensive, K-12 computer science integration using CS4All's Strategic CSforALL Resource & Implementation Planning Tool (SCRIPT) framework. The framework supports districts in evaluating their existing CS programs, identifying barriers to student access and implementation, and establishing actionable goals to build a robust and inclusive K-12 computer science pathway. Robeson, Winston-Salem, Pender and Cumberland County have all trained teams of teachers, administrators and support staff using the SCRIPT program.

Districts have highlighted a number of barriers to computer science implementation, with supplies and teacher capacity being at the top. There are currently not enough educators to teach the computer science courses necessary to meet the NC High School Computer Science Requirement. This is especially true in smaller, rural districts. Most districts began to supply devices to students for remote instruction during the COVID pandemic. These devices are reaching their end-of-life date though, and districts will need to purchase new devices for students. A survey conducted by WRAL showed that several districts in the state currently do not have the funding to refresh student devices when the current devices become obsolete (Walkenhorst & Hagel, 2024). This will put an enormous financial strain on those districts, leaving some unable to keep up with demand.

Spotlights on NC CS Ecosystem Partners

1. Research uncovered several computer science education partners that reside in North Carolina. These partners train, work with and volunteer with educators across the state to ensure comprehensive CS education for all students across the state.
2. The North Carolina Computer Science Teachers Association (NC CSTA) acts as a virtual professional learning community (PLC) for educators across the state. This association holds virtual meetings to connect educators so that they may collaborate and seek assistance from one another. CSTA also offers educators access to national professional learning opportunities, free and discounted Praxis exam preparation, and award and recognition opportunities (CSTA North Carolina, n.d.).
3. CS4NC is a voluntary group of educators, business leaders, curriculum developers and higher education faculty and staff that collaborates to expand and enhance CS education for students across the state. This group works together to brainstorm new opportunities for educators and students through the sharing and development of ideas. Part of the national Expanding Computing Education Pathways (ECEP), CS4NC has developed landscape reports for the state, held summits to bring together leading stakeholders from across the state and assisted in collecting, organizing and disseminating computer science education statistics so community members and legislators can better understand the status of CS education in the state (CS4NC, n.d.).
4. The SCRIPT strategic planning program, offered through CS4All, works with districts to assist them with strategic planning for kindergarten through 12th grade computer science. This program is designed to help districts understand where they are with CS implementation and set goals to help improve educational access and engagement for students. The SCRIPT program is flexible and intended to meet the needs of districts regardless of whether they have no CS implementation or have already begun.
5. The North Carolina Technology in Education Society (NCTIES) is a “membership association for education and educator leaders engaged in advancing excellence in learning and teaching through the effective use of technology.” NCTIES provides advocacy for education in North Carolina, awards and recognition for education and holds an annual conference to bring together educators from across the state to engage with professional development and innovators in the educational technology field (NCTIES, n.d.).

Computer Science Education Programs for Pre-Service Educators

The current landscape of pre-service teacher preparation for Computer Science (CS) education in North Carolina reveals a significant gap: there are no dedicated college-level courses specifically designed to train future educators in CS pedagogy.

While no public universities in North Carolina are currently listed as offering CS pedagogy to pre-service educators, some private institutions are integrating CS and CS-adjacent concepts into their teacher preparation programs:

- High Point University introduces pre-service educators to foundational concepts in computer science, digital pedagogy, critical thinking, and design thinking. This is achieved using tools like Micro:bits and Lego Spike Essentials, providing hands-on experience with relevant technologies
- Greensboro College integrates Digital Learning Competencies into various courses within their K-12 education program, aiming to equip future teachers with essential digital skills that can support CS education

This lack of comprehensive CS education programs for pre-service teachers is not unique to North Carolina. A study conducted by the University of Washington highlighted a nationwide deficiency, finding that only 78 universities across the country offer dedicated computer science pre-service educator programs.

However, examples of robust programs elsewhere demonstrate potential models for North Carolina:

- The University of Washington offers a notable program called “Step CS” as part of their master’s in teaching degree. Over the past four years, this program has prepared approximately 50 CS educators. Students in this program engage with specialized courses such as Justice and Equity in Computer Science Teaching, Teaching Computer Science in Secondary Schools, and Field Experience Computer Science – Secondary (STEP CS, n.d.).
- The University of Texas-El Paso has two options for CS education certification. Students may enter a dual degree program where they receive a bachelor’s in education and computer science, followed by a teacher residency and certification. Postgraduates may also enter a CS residency pathway to receive their CS teacher certification.

Alabama has developed the program SEED4CS Alabama, whose goals include 1) Recruiting and enrolling up to 90 secondary teacher candidates in pursuit of a CS endorsement; 2) Producing 72 Credentialed secondary teacher candidates; and 3) Producing 45 full CS subject endorsed secondary teachers (Seed 4 AL CS – Secondary Ed for AL CS, n.d.).

The program is broken down into three phases. In the first phase, students take CS 104-Computer Science Principles. In phase two, students participate in a two-day campus collaborative event and take either CS 491 or CS 591 (CSP Curriculum). Finally, in the third phase, students prepare for the Computer Science Praxis II. As incentive, each phase provides students with a stipend and tuition coverage.

These examples underscore the need for North Carolina to develop more structured and comprehensive programs to adequately prepare future teachers to deliver high-quality computer science education across the state.

Conclusions and Recommendations

North Carolina has made great strides to ensure computer science is a part of every student's education. Over the past 10 years, the state has established a graduation requirement for all high school students, K-12 computer science standards and a computer science director position at the state level. The state has also dedicated funds to professional development to ensure educators from all backgrounds are prepared to teach middle and high school students.

However, the state now runs the risk of falling behind surrounding states. For instance, South Carolina and Georgia lead North Carolina in percentage of high schools offering computer science courses. Texas and Alabama have made strides in pre-service teacher education. Louisiana has also dedicated seven million dollars over the past two years to ensure all students have access to computer science education (State of Computer Science Education Report | Code.org Advocacy Coalition, n.d.).

Below is a list of recommendations to ensure that North Carolina can stay competitive:

- **Expand district implementation programs** such as SCRIPT to all North Carolina school districts: District implementation programs are designed to help educational institutions evaluate their current computer science offerings and develop comprehensive plans to ensure all students have access to computer science. For example, SCRIPT brings together diverse teams of educators, including teachers, librarians, and school and district administrators, ensuring that a wide range of perspectives, needs and goals are considered and addressed throughout the entire strategic planning and implementation process.
- **Create a CS Education pathway as well as CS pedagogical courses** in partnership with UNC System teacher preparation programs: It is essential that future educators understand the importance of teaching CS and how to effectively integrate it into their curriculums. Teachers are currently reliant on professional development while in the classroom, adding unnecessary stress for in-service teachers. Teachers are also expected to explore and develop CS-integrated lessons on their own, taking unnecessary risks with

student achievement. College level courses on CS integration would assist educators in confidently integrating computer science across all curriculums.

- **Fund a CS Engagement Dashboard** to track participation and access by demographics and region: To ensure access and participation in computer science education across North Carolina, it is essential to fund and maintain an up-to-date Computer Science Engagement dashboard. This crucial tool would provide parents, educators and administrators with clear insights into the status of CS education within North Carolina schools, facilitating accountability for computer science implementation. As the state rolls out its computer science graduation requirement, it is imperative that all stakeholders, including parents and state-level administrators, can easily track the progress their districts and schools are making in this vital area.
- **Target engagement campaigns** to increase participation among girls; black, latino and indigenous students; and rural schools: Data shows that the majority of students who participate in CS high school courses are white and male. This creates an inequitable workforce for computer science. Programs such as Girls Who Code, 4H, and Latinos for CS can assist in engaging people from diverse backgrounds in computer science. Schools and districts can also adopt engaging curriculums that provide students with the opportunity to express themselves through projects. Programs such as EarSketch, TunePad and Code.org's Music Lab expose students to computer science while also allowing them to write songs and learn music.
- **Establish ongoing computer science education and equipment funding** in the state budget: The North Carolina Computer Science Graduation requirement, while a crucial step forward, currently operates as an unfunded mandate. This places significant financial strain on school districts as they grapple with funding teacher positions, professional development and the acquisition of necessary equipment. To ensure equitable access and successful implementation, districts urgently require ongoing financial assistance for professional development, curriculum resources and equipment, particularly for K-5 computer science integration. Providing early exposure to computer science is essential before students enter secondary-level courses. By establishing a dedicated computer science education fund within the state budget, this financial burden on districts can be alleviated and they can be empowered to provide the essential resources needed for robust computer science instruction across all grade levels.

While North Carolina has made significant progress in computer science education, it's at a critical juncture. To avoid falling behind neighboring states and to ensure every student has access to engaging computer science material, the state must proactively invest in teacher preparation, curriculum development and dedicated funding. These strategic investments will solidify North Carolina's position as a leader in preparing its students for the jobs of tomorrow.

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Jaclyn Stevens empowers educators and leaders to design adaptive, student-centered learning experiences, guided by her philosophy to “adapt, not adopt.” At the Friday Institute for Educational Innovation, she leads professional learning and research initiatives in digital literacy, computer science and AI integration. Her work bridges instructional design, technology access and translational research to advance innovative curriculum and strengthen educator capacity.

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